

BROADWAY

PNEUMATIC

UNDERGROUND RAILWAY.

WITH A

Full Description of the Atmospheric Machinery and the Great Tunneling Machine.

New-York:

S. W. GREEN, PRINTER, 16 & 18 JACOB STREET.

1870.

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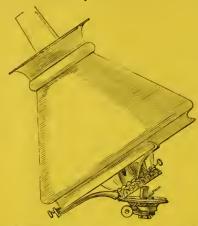
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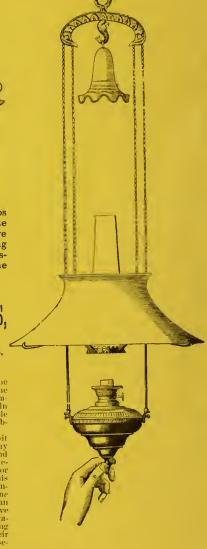
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IVES' PATENT LAMP CO.,

Barclay Street and 42 Park Place, New-York.

LAMPS FOR EXPORT.

ILLUSTRATED DESCRIPTION

OF THE

BROADWAY

PNEUMATIC

UNDERGROUND RAILWAY

WITH A

FULL DESCRIPTION OF THE ATMOSPHERIC MACHINERY, AND THE GREAT TUNNELING MACHINE.

NEW-YORK:

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GENERAL DESCRIPTION

OF THE

BROADWAY PNEUMATIC UNDERGROUND RAILWAY,

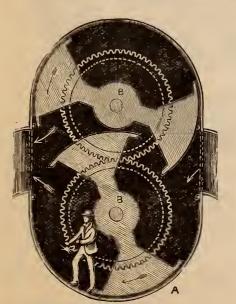
ÆOLOR, TUNNELING-MACHINE, ATMOSPHERIC CARS, ETC., ETC.

ENTRANCE AND TICKET-OFFICE.

The present entrance to the Underground Railway is at the south-west corner of Broadway and Warren street, through the basement portions of the large and splendid marble edifice known as Devlin's building.

Descending a few steps from the sidewalk, the visitor enters the ticket-office, where the attention is at once arrested by the color or blowing-engine, which generates the air-blast by which the pneumatic cars are propelled.

This immense æolor is by far the largest machine of the kind ever made. It consists of a great shell of strong iron, twenty-one and a half feet high, sixteen feet long, and thirteen feet wide, containing two pairs of massive wings, geared together by cog-wheels, and so arranged that the air is drawn in upon one side of the machine, carried through between the



SECTIONAL ELEVATION OF THE GREAT ÆOLOR.

wings, and forced out on the other side. We give a sectional view of the æolor, showing the form of the wings.

This remarkable machine weighs fifty tons, or rather more than a common locomotive engine. The æolor is to the pneumatic railway what the locomotive is to the ordinary steam railroad. The locomotive supplies the power to draw the ear; the æolor gives motive force to the air by which the pneumatic car is moved.

The æolor is capable of discharging over one hundred thousand cubic feet of air per minute, a volume equal in bulk to the contents of three ordinary three-story dwelling-houses. The machine makes sixty revolutions per minute.

It is by the enormous air-current generated by such machines that trains of cars are impelled upon the atmospheric railway with great velocity.

The present color was made by the patentees, Messrs. P. H. & F. M. Roots, at their large establishment in Connersville, Ind. Its cost, set up complete, was about \$20,000, and for its transport from Indiana to New-York, a train of five large platformcars was required. The machine bears the appropriate name of "The Western Tornado." The Messrs. Roots are manufacturers of a great variety of sizes of these blowing-machines, and they are extensively used in iron-smelting furnaces, cupolas, etc., in all parts of the country; the smallest pattern, for blacksmiths' forges, hardly exceeds the size It takes the place of the comof a man's hat. mon bulky leather bellows, is turned by a crank, runs easier than the bellows, and delivers more air. Other sizes are used for blast-furnaces. Mr. S. S. Townsend, No. 31 Liberty street, New-York, is the general agent.

The upper portion of the æolor, as seen in the ticket-office, is beautifully decorated, and presents no outward indication of being the great reservoir of power we have just described. To realize this fact,

we must go down-stairs and look within its eapacious mouths.

Leaving the ticket-office and passing the æolor on the left, we enter the

WAITING-ROOM OF THE BROADWAY UN-DERGROUND RAILWAY.

This is a large and elegantly finished apartment, commencing at Broadway and extending down Warren street for a distance of one hundred and twenty feet, built wholly under ground. The walls are handsomely finished and adorned with interesting pic-

THE PNEUMATIC PASSENGER-CAR.

One of our views shows the interior of the car. It is of circular form, richly upholstered, brilliantly lighted, and very comfortable, with seats for twenty-two persons. Its interior height is greater than the cars of the London underground railways.

The wheels of the pneumatic car are provided with separate axles and springs. The general construction is such that the floor of the car stands below the axle centres, an arrangement which tends to produce steadiness of motion and security from accident. Powerful brakes are placed at each end of



INTERIOR OF THE PNEUMATIC PASSENGER-CAR.

tures, while comfortable settees, looking-glasses, fountains, saloons for ladies and gentlemen, and other furnishings, render the place at once cheerful and attractive.

At the east end of the waiting-room we descend a half-dozen steps, and find ourselves upon the railway platform, near the portal of the tunnel, and at the door of the ear, so made that the brake-shoes press upon a central rail, laid on the floor of the tunnel, midway between the two ordinary rails, as shown in the engraving. By means of these brakes the car may be lifted bodily, and its entire weight brought upon the brake-shoes, which slide upon the central rail, and quickly bring the car to a halt.

One of the advantages of the Pneumatic Railway

for city transit is, that the cars may be run either singly or in trains, without additional machinery or cost. The more frequently the cars run, the better are the public accommodated. On ordinary steamroads, if the cars are sent singly, a locomotive must accompany each car, which would be expensive; hence the practice is to run the cars in trains. It is probable that pneumatic cars could, for the same ex-

and explore the underground mysteries of Broadway. The rumbling noise of the vehicles which pass in endless procession, directly over our heads, can be distinctly heard.

The tunnel commences at the curb-line of Broadway, and sweeps on a graceful curve a little beyond the centre line of the street; thence on a straight line down Broadway to a point a little beyond the sout!



PORTAL OF THE BROADWAY TUNNEL.

pense, be dispatched through a Broadway tunnel much oftener than locomotive trains could be run.

When there is an unusual rush of visitors at the Broadway tunnel, an additional platform-car is employed, on which counfortable settees are placed, for twenty-five or thirty passengers. This car is provided with a wooden sail at one end, against which the atmospheric current presses.

THE TUNNEL UNDER BROADWAY,

the portal of which, massive and ornamental, of circular form, stands before us as we face the east.

We will follow the railway track into the tunnel,

side of Murray street. The bed of the tunnel is twenty-one and a half fect below the pavement. The interior is painted white; it is lighted with gas; the atmosphere is pure; and a walk through it will be found interesting and instructive. The length of the tunnel is three hundred and twelve feet, of which the curved portion, sixty feet, is built of iron plates, the interior diameter being nine feet. Standing upon the track platform, at a little distance from the tunnel, and looking within the portal, the iron walls, with their net-work of gracefully curved ribs, present a very pleasing appearance. This method of erecting iron tunnels is the invention of Mr.



Joseph Dixon, the secretary of the company, long known for his persevering efforts to establish the underground railway in New-York.

The iron track, of the usual T pattern, rests upon longitudinal beams of wood, secured to the brick walls, and fastened cross-wise at intervals by flat girders of east-iron.

In summer-time, the tunnel is the coolest place in the city. When the thermometer stands at 95° at the surface of the street, it indicates only 65° in the tunnel. In winter, the temperature in the tunnel is usually warner than the external air.

Telegraph wires extend along the walls of the tun-

nel, which are so arranged in connection with the track that the wheels of the car, when the latter reaches the ends of the tunnel, send back a telegraph signal to the engineer, who shifts an air-valve, which reverses the air-current and causes the ear to move back to its starting-place. Proceeding down Broadway to the end of the tunnel at Murray street, we come to the

GREAT TUNNELING MACHINE OR SHIELD,

by which Broadway was bored without any body knowing it, with all the omnibuses and other vehicles traveling directly above the heads of the workmen. We present two views of this novel mechanism, one of which shows the workmen engaged in driving the machine ahead; the other, on page 11, showing the details of construction. The shield consists of a large cylinder, open at both ends, with shelves arranged within the front end to receive the earth and prevent it from falling too rapidly into the shield; at the rear of the latter, placed around its periphery, is a series of powerful hydraulic rams, eighteen in number, all connected with a single water-pump. From the rear of the shield, and passing entirely around it, extends a hoop or band of sheet steel, two feet wide, and one eighth of an inch thick, termed the hood. The brick

of the masonry tunnel is erected within the hood. The shield is then again pushed forward, and so on. By means of this machine, tunnels of all kinds and sizes may be quickly constructed under the streets without disturbing the travel of vehicles over the surface. The shield may be readily moved around curves or on grades. Where tunneling at any considerable depth below the surface is required, the use of this machine saves a large amount of labor. Eight men, working with two of these machines, are enabled to excavate the earth and erect within the excavation eight running feet of completed tunnel per day.



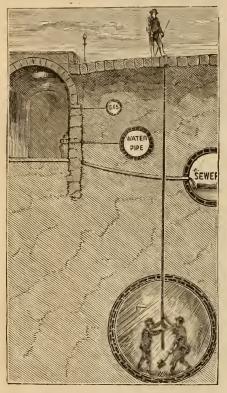
VIEW LOOKING FROM WITHIN THE TUNNEL TOWARD THE STATION, SHOWING THE PNEUMATIC CAR, ETC.

tunnel is erected within this hood, which at all times covers the end of the masonry, and prevents the earth from falling upon the workmen. After a section of the tunnel sixteen inches long has been erected within the hood, the pump is operated, which causes the rams to slide out from the shield, and push with great force against the front edge of the tunnel, driving the shield forward into the soil. As the shield advances, the earth presses through between the shelves, and falls down upon the bottom of the shield, whence it is removed in barrows and cars. As soon as the shield has been advanced sixteen inches, "its movement is stopped, and a new section

This machine was designed by Mr. A. E. Beach, of the Scientific American, and was built by the Holske Machine Company, 528 Water street, under the personal superintendence of Mr. William F. Holske. The splendid hydraulic rams and pump were made at the celebrated hydraulic engineering establishment of E. Lyon, 470 Grand street, New-York, from the drawings and under the special superintendence of Mr. Thomas G. Watson, mechanical engineer. The system of hydraulic rams used in this tunneling machine is worthy of special note for its novelty and success. It reflects the highest credit upon the constructor and engineer.

HOW THE MACHINE WAS STEERED,

The shield was steered around the curve and down Broadway by turning the stop-cocks of water-pipes belonging to the hydraulic rams, thus changing the pressure from side to side as occasion required. During the progress of the work under Broadway, the exact course traveled by the shield was determined by compass and survey in the usual manner, and the lines were from time to time verified by driving jointed rods of iron up through the roof of the



TESTING THE POSITION AT NIGHT.

tunnel to the pavement, as indicated in our sketch. This was done in the night-time, after the stages had ceased running.

HOW THE CARS ARE OPERATED."

Having presented a general description of the tunnel, the cars, and the æolor or blowing-machine, we will now briefly describe the manner in which the cars are operated. To do this intelligently, reference should be made to the engraving of the general plan of the premises on the next page.

Two air-valves will be noticed, which operate in connection with the air-passages of the blower or æolor. When the blower is in motion, an enormous volume of air is driven through the tunnel, which

drives the car before it like a boat before the wind. On arrival of the car at Murray street, the car wheel strikes the telegraph wire and sends back a signal to the engineer, who shifts the position of the two air-valves, thereby reversing the air-current by causing the blower to suck the air from the tunnel, and discharge it into the area-way of the building. In this process of suction the air is drawn in through a temporary ventilator at Murray street and passes through the tunnel to the blower at Warren street, the passenger-car being swept by the force of the current back to Warren street, where the wheel again strikes the telegraph wire, gives a signal to the engineer, who again moves the valves, and back the car moves to Murray street.

Whenever the cars are operated, crowds of people assemble around the grating of the temporary ventilator at Murray street, to enjoy the effects of the great air-blast which there issues with a rushing sound. In summer-time when the surrounding air is hot and oppressive, this pneumatic blast is very refreshing, and appears to be highly appreciated by the surrounding crowd; amusing scenes and colloquies frequently take place. Straw hats by the dozen are sometimes seen sailing high in the air, lifted suddenly from the heads of unsophisticated spectators who place their heads too near the ventilator.

It is frequently asked whether the passing of the air-current directly into the waiting-room does not make the apartment uncomfortable, by producing therein an undue air pressure, or strong draughts. A little consideration will show that there can be no such difficulties. The waiting-room, or station, is built entirely underground, and there can be no leakage of air through it, except when the entrancedoors are thrown open. These are double doors, and when one is open the other is closed, all leakage of air being thus prevented. The atmosphere of the station or waiting-room is, therefore, not disturbed by the rush of air to and from the tunnel, and the visitor is not aware that an alternate compression and exhaustion of the air is going on within the station, unless the eye rests upon the pressure-gauge which hangs upon the wall, the rise and fall of which exhibits the changing pressure.

The car runs so easily upon the track that only a few grains of atmospheric pressure to the square inch are sufficient to move the car with a considerable velocity. This pressure is so small that the visitor within the station does not perceive it.

A RIDE UNDER BROADWAY BY ATMOSPHE-RIC PRESSURE.

The great number of visitors constantly in the tunnel, eager to walk under Broadway and examine the great boring-machine, renders it impossible to

run the passengercar during the regular hours alloted for public admission. The evenings have therefore been reserved for this purpose; and a visitor, who recently formed one of a party of ladies and gentlemen who enjoyed the evening atmospheric ride, describes the sensation as follows: "We took our seats in the pretty car, the gayest company of twenty that ever entered a vehicle; the conductor touched

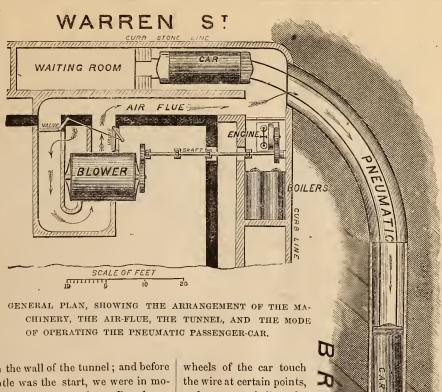
a telegraph wire on the wall of the tunnel; and before we knew it, so gentle was the start, we were in motion, moving from Warren street down Broadway. In a few moments the conductor opened the door, and called out, 'Murray street!' with a business-like air that made us all shout with laughter. The car came to a rest in the gentlest possible style, and immediately began to move back again to Warren street, where it had no sooner arrived, than in the same gentle and mysterious manner it moved back again to Murray street; and thus it continued to go back and forth for, I should think, twenty minutes, or until we had all ridden as long as we desired. No visible agency gave motion to the car, and the only way that we upon the inside could tell that we were being moved by atmospheric pressure was by holding our hands against the ventilators over the doors. When these were opened, strong currents of pure air came into the car. We could also feel the air-current pressing inward at the bottom of the door. I need hardly say that the ventilation of the pneumatic car is very perfect and agreeable, presenting a strong contrast to the foul atmosphere of the ordinary city cars. Our atmospheric ride was most delightful, and our party left the car satisfied by [actual experience that the pneumatic system of traveling is one of the greatest improvements of the day.

"Having thus described our experience in the car, I ought now to tell you how it was done. You must know then that a telegraph wire runs through the tunnel, which is so connected with the track that the

wheels of the car touch the wire at certain points, and cause a bell to be sounded in the main building, where the æolor, or blowing-engine, is situated; and when the engineer hears the bell, he pulls a rope, which operates an air-valve, so as to let in or change the air-current in the tunnel. For example, just before our car stopped at Murray street, the wheel of the car sent the signal to the

gineer, who shifted the valve, when instantly the blowing current was changed to a suction current, which drew us back to Warren street; and just before we arrived there, by another signal, the current was again changed, and down we went to Murray street.

"The air presses directly against the end of the car, and we were carried along just like a sail-boat before the wind. A car mounted on a track is moved much easier than a boat upon the water, because the vessel encounters great resistance in displacing the water, while the car merely has to overcome the friction of the wheels, which is only one four-hundredth part of its weight. Therefore only a small air pressure is required to drive a pneumatic car with



a high velocity. At the time of our ride, the velocity was perhaps six miles an hour, and the air pressure was only a few grains to the inch. It would not be safe to run any faster in this short tunnel; but when the road is extended, the cars will move at from thirty to sixty miles an hour.

"I ought to mention that down near Murray street there is a ventilator extending from the tunnel to a grating on the sidewalk, through which the air-column enters and leaves the tunnel.

"I must not omit to tell you of our experience inside of the air-ducts, where the air-blast issues.

THE WESTERN TORNADO.

" After we had had our ride, it was only natural, of course, that we should wish to explore the source from whence came the pneumatic pressure that had so mysteriously carried us along under Broadway. Accordingly, under the guidance of one of the polite officials of the company, provided with lanterns, we entered the air-passage, or duct, which opens into the waiting-room near the mouth of the tunnel. This passage is fifty or sixty feet long, and four and a half feet high. As we went in, we felt a gentle breeze; but after we arrived at the mouth of the great blower, and while we were gazing in wonder at the motions of the gigantic blowing wings, the engineer put on more steam and increased the speed, so that the blast instantly became a hurricane of frightful power. Hats, bonnets, shawls, handkerchiefs, and every loose thing, were snatched away from our hands and swept into the tunnel; while all of us, unable to stand against the tornado, hastily retreated from the machine to a corner of the air-box, where we were slightly sheltered. At this juncture the speed of the æolor was reduced, the storm was over, and only a gentle summer's breeze issued from its enormous throat. We retired from the presence of the machine, some of us thoroughly frightened, and thankful that it did not quite blow the life out of us. We had heard that New-York was a great place for blowers of various kinds; but of all the devices in this line, the palm belongs to the great æolor of the underground railway."

HOW THE CARS STOP AT WAY-STATIONS.

The tunnel, as it approaches the station, is enlarged, so that air may pass the cars, the speed of which is diminished by the application of brakes. The cars are brought to a halt within the station, and remain standing upon a slight down-grade, while the air current from one branch of the tunnel continues on through the station into the other branch of the tunnel. On releasing the brakes, the force of the air impinging against the rear car, assisted by the grade, gently starts the train forward into the mouth of the tunnel, where it receives the

full force of the air-current, and is driven onward to the next station.

HOW THE TUNNEL CAME TO BE BUILT.

The present tunnel under Broadway has been constructed under the auspices of the Beach Pneumatic Transit Company, a corporation chartered in 1868, with authority to convey letters, parcels, and merehandise through tubes not to exceed fifty-four inches mean interior diameter. It was ascertained by the company, after careful investigation, that the cost of laying down two tubes of the above size, constructed together, would be but little more than that of building a single tube. It was also ascertained that the quickest and best method of construction for the two tubes was to bore under the streets, below the water-pipes and sewers, and erect a masonry shell or tunnel large enough to inclose both of the fifty-four-inch tubes. It is a portion of this outer tunnel that has been erected; and as it proves to be strong enough and large enough for the transit of passengers, it is to be hoped that the company will be authorized by law to omit their intended division wall, and open their tunnel for passenger traffic.

For this purpose a memorial, of which the following is a copy, may be found at the company's offices, where all who favor the enterprise may enroll their names—about fifty thousand persons have already attached their signatures:

MEMORIAL TO THE HONORABLE SENATE AND ASSEMBLY
OF THE STATE OF NEW-YORK.

The undersigned, inhabitants of the county of New-York, or doing business in the city of New-York, and residing in Kings, Queens, Westchester, Richmond, or adjacent counties, respectfully represent:

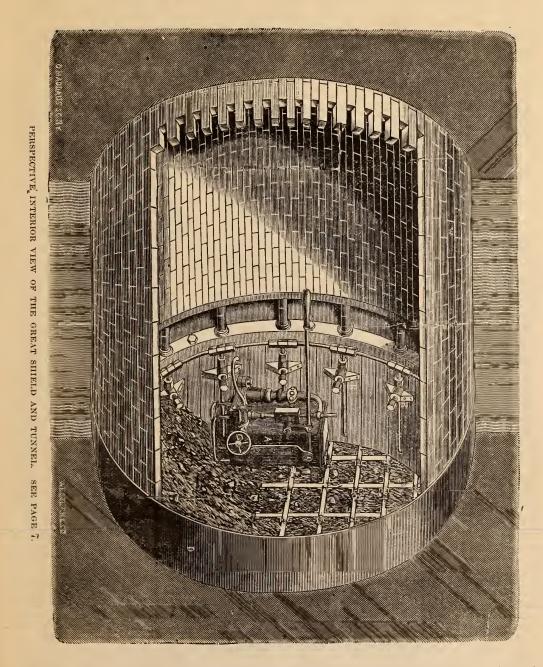
That the introduction of the Pneumatic Railway is an improvement worthy of every encouragement, as calculated to promote the public convenience, by providing a safe and rapid means of underground communication, now greatly needed in the city of New-York.

Your memorialists, therefore, respectfully pray your honorable bodies to grant authority to the Beach Pneumatic Transit Company to carry passengers in their pneumatic tubes, subject to such regulations as your honorable bodies may deem best.

And your memorialists will ever pray, etc.

CARRYING CAPACITY OF THE PNEUMATIC RAILROAD.

"We have," says Frank Leslie's Newspaper, "made a little calculation on this point, and find that with two tubes such as that already erected, but perhaps



a trifle larger, and with trains starting every two minutes, the company could carry from ten to fifteen thousand passengers per hour from Harlem River to the South Ferry, and probably double that number, should it ever become necessary. At a comparatively moderate rate of speed, the time occupied in traveling the whole distance would not exceed twenty minutes.

"The company are now by law required to erect receiving-boxes upon the side-walks for the public

convenience in depositing letters and packages for dispatch in their pneumatic tubes, which is all very well. But what the people more imperatively need is the provision of facilities for carrying passengers with comfort and speed. This can be readily done under the pneumatic system, and therefore we think that the company ought to be compelled by law to do it, and the sooner the better."

NOTES FROM THE NEWSPAPERS.

A VERY excellent description of the Pneumatic Tunnel, with many illustrations, will be found in Frank Leslie's Newspaper of Feb. 19th, 1870.

The New-York Tribune, the New-York Sun, and the New-York Herald have also given illustrations of the tunnel. The greatest interest in the success and progress of the work has been expressed by the press of New-York and Brooklyn, and adjacent places. The almost universal desire of the press and the people is, that the Legislature will give the company the right to carry passengers, and cause the work to be extended throughout the city as quickly as possible.

From the Scientific American.

THE TUNNEL UNDER BROADWAY.

Something of a fragmentary and, in most respects, unreliable character has found its way into the daily papers relative to the important work now in progress under Broadway in this city, known as the Pneumatic Tunnel. So far as the accounts of some legal proceedings, to which the work has given rise, and its present extent, are concerned, the statements made by the journals are, in the main, correct; but the real scope of this important experiment, and the benefits which its successful completion are destined to confer upon the city itself, seem either not to be fully understood, or to be looked upon with incredulity.

lity.

We have said this is an important experiment. So far as the working of such a tube is concerned, it is not an experiment, but a well demonstrated fact. It is only an experiment in a financial and business point of view. That upon the completion of the tunnel and its opening to public transit a gratifying result will reward its projectors, we entertain no doubt

whatever.

Although the President of the Beach Pneumatic Transit Company is one of the proprietors of the Scientific American, the writer of the present article visited the tunnel for the first time on the 8th of February. The day was stormy and the snow fell fast and heavy. Cars were with difficulty kept on the tracks in the streets. Umbrellas were in vain. The wind made no more of turning them inside out than of shaking dead leaves from the trees in the park. It was a favorable time to contrast the miseries and annoyances of street car travel with the comfort of tunnel transit.

Entering at the south-west corner of Warren street and Broadway, we were soon initiated into the mysteries of which so much has been made by the newspaper reporters. The simplicity of the principle of this mode of transit is not fully appreciated until

one sees the thing itself.

Let the reader imagine a cylindrical tube eight feet in the clear, bricked up and whitewashed, neat, clean, dry, and quiet. Along the bottom of this tube is laid a railway track, and on this track runs a spacious car, richly upholstered, well lighted, with plenty of space for entrance and exit. The whole arrangement is as comfortable and cozy as the front basement dining-room of a first-class city residence. The tunnel has not only the positive comforts de-

scribed, but it is absolutely free from the discomforts of surface car-travel. The track is smooth and level, and, not being subjected to incessant battering from heavy trucks, is easily kept in first-rate condition. It is not cold in winter. It will be delightfully cool in summer. The air will be constantly changed in it by the action of the blowing-engine. The filthy, health-destroying, patience-killing street dust, of which up-town residents get not only their fill, but more than their fill—so that it runs over and collects on their hats and clothes; fills their hair, beards, and eyes, and floats in their breaths like the vapor on a frosty morning—will never be found in the tunnel. Add to these advantages that of cheap, rapid, and uninterrupted transit, free from the dangers of collision with loaded trucks, and we have a pretty fair showing in favor of the tunnel over street railways.

When the tunnel is opened to the public, it will be no dirty hole in the ground the people will be invited to enter, but a handsome subterranean avenue, through which they may be rapidly transported to

their homes up-town.

This system is in our opinion vastly superior to the subterranean steam transit under Broadway, as has been proposed. Its first cost is very much less. It is free from the smoke nuisance and from the dust of locomotives. There can be no accumulation of carbonic acid gas in it—an evil which may be estimated from the fact that for every pound of coal burned, three and one third pounds, or twenty-nine and one half cubic feet, of carbonic acid will be generated. Granted that this gas will find free exit from the area-ways, at the side of the street, so that people can breathe and live below, it will float off into the stores alongside, descend into the cellars, and become a general nuisance.

In the pneumatic system, the cars will be impelled by compressed air only. This air will be uncontaminated by gas or dust, the track will not be crushed and damaged by heavy locomotives, and all the discomforts of steam travel through tunnels will

be eliminated.

The present apparatus in the basement of the building at the corner of Warren street and Broadway, comprises a stationary engine of one hundred horse-power, with boiler, and a Root's Pressure Blowing-Engine, capable of delivering to the tunnel one hundred thousand cubic feet of air per minute. We may on a future occasion give a more detailed

account of this apparatus.

There is no doubt that this method of transit might be made not only the means of easy and rapid communication between the upper and lower parts of the island, but also between New-York and Long Island, and New-York and New-Jersey, through tubes underneath the North and East rivers. The relief which this would give to surface travel and the convenience it would afford to suburban residents, would increase the value of real estate, and greatly add to the comfort and luxury of metropolitan life.

From Frank Leslie's Newspaper.

THE BROADWAY PNEUMATIC TUNNEL.

The series of engravings pertaining to the Pneumatic Railway which we this week present, illustrate the progress of a remarkable work, planned and executed in a remarkable manner. Our great metropolitan thoroughfare has been bored, arched, and a track

laid down, by a corps of sappers and miners, who have operated with surprising rapidity and success. They have not only tunneled Broadway, but have done so with the surging throng of humanity, animals and vehicles, marching in endless procession directly above their spades. No outward indications of activity below the ground have been exhibited, and, until quite recently, the public has had no knowledge of the matter. The works are hidden by knowledge of the matter. The works are hidden by the granite pavement of the street, and but for our engravings, taken from the subterranean structures themselves, it might be difficult to satisfy our readers that we have above stated only the facts.

The Underground Railroad, the highway for rapid city transit, long needed and pressingly demanded by the inhabitants of New-York, has at last been commenced, and a short portion has been put in actual operation. We trust it will not be long ere we shall be able to chronicle the full completion of the work from the Battery to the Harlem River. It is evident, from the example now before us, that the construction of an underground railway in this city is not a difficult nor, necessarily, a tedious operation. Six months or a year's time is quite sufficient, the ways and means being provided, with enterprising men as conductors.

From the New-York Evening Mail, Feb. 26, 1870.

THE GREAT BORE.

COMPLETION OF THE FIRST SECTION OF THE BROAD-WAY UNDERGROUND RAILWAY-A GREAT SUCCESS.

The problem of tunneling Broadway has been solved. There is no mistake about it. Even as we write, a comfortable passenger-car is running smoothly and safely between Warren and Murray strects, demonstrating beyond contradiction that it is only a question of time and money to give us rapid and comfortable transportation from the Battery to Harlem and back again. Nearly three months ago The Evening Mail was the first journal in the city to announce the existence of this great bore beneath Broadway. In our columns were then described the progress of the work and enough of the plans of the projectors to give a clear idea of what the public were to expect from them. Since theu the work has been pushed vigorously on by competent workmen, under a thoroughly competent superintendent, whose name is Dixon; may his shadow increase for evermore! This afternoon, pursuant to invitation, the completed section of the work will be prospected by the Mayor, and other members of the city government, and the leading capitalists of the city, and that this visit will be followed by a general hallelujah, no sane man doubts who has sat in that cozy car over twenty fect beneath the surface of Broadway, and been whiffed from Murray street to Warren before he had time to say, "God bless you!"

We have said that the bed of the tunnel is twentyone and a half feet beneath the surface of the street. It will then be understood that it is below both sewers, and water and gas pipes, and so far below them as neither to interfere or be interfered with.

The completed section illustrates satisfactorily that there is nothing now to be done but give this com-

We can afford to the passenger-carrying scheme. wait awhile longer for the parcel tubes much better than we can bear the increasing discomforts of the surface railroads.

It is truly most gratifying to see how admirably successful the affair has been carried out so far, and so quietly as to excite no comment. There is the capacious waiting-room, one hundred and twenty feet long, for passengers, as perfect in its appropriateness as if it had been the starting-place for uptown for a dozen years. There is the snugly upholstered passenger car, illuminated with the brilliant lime light, the tunnel nearly three hundred feet in length, the engine and the monster fans-all under Broadway, and "nobody a bit the wiser," one might say.

From the New-York Herald, Feb. 27, 1870.

"UNDER BROADWAY."

PROPOSED UNDERGROUND RAILROAD—A FASHIONABLE RECEPTION HELD IN THE BOWELS OF THE EARTH-THE GREAT BORE EXPLORED.

"UP Broadway" and "Down Broadway" are familiar routes, familiar not only to Americans residing in New-York, but by description to all the inhabitants of the world. "Under Broadway" for two hundred and ninety-four feet, right away, in a thoroughfare well-lighted, in a scrupulously clean avenuc, is not quite so familiar. Yesterday, hundreds of our citizens, including state officers, members of the Legislature, city officials, and members of the press, walked along a part of Broadway they never were in before, and more enjoyable than if they had been on the sidewalk of the well-known thoroughfare of the Empire City instead of twelve fect below it.

An engraved invitation note asked those who had the good fortune to receive it, to attend an "Under Broadway Reception," at the office of the "Beach Pneumatic Transit Company," 260 Broadway, from

two to six o'clock yesterday.

Descending an ordinary basement "dive," under Devlin's clothing store, the visitors found themselves in a comfortable office, and a few steps lower there was a kind of Aladdin's cave opened to view, in which there was more to be seen than the eye could take in at once, and therefore we must ask the reader's attention

to a few particulars. First of all, let us explain the reason why this descent was made into the bowels of Broadway, and why all these important representatives of the public had been asked to come and gaze and wonder. Legislative power has been obtained to construct a pneumatic tube way from Warren street to Cedar street, for the purpose of "blowing" small and large parcels-indeed, all kinds of "express business "-between these two localities. The promoters had not proceeded far with their work before they discovered that it would be very little more expense to construct an underground railroad for the blowing of passengers as well as freight. Acting upon this hint, they have applied to the Legislature for power to con-struct this underground railroad; and if the calm, settled, and earnest approval of their plan by the representatives of the scientific and executive ability of the city be an earnest of their success, it will not be difficult to obtain the sanction of the Legislature pany such a charter as will enable them to go on with to their bill. Virtually, therefore, yesterday's reception was the opening day of the first underground railway in America,

THE TUNNEL AND THE BORE.

The length of the tunnel already open is 294 feet; the iron portion of it is 57 feet; the brick, 237 feet. It is whitewashed and lighted with gas, has telegraphic wires running alongside the wall, is about 12 feet high, and formed a very pleasant promenade. The roar of the Broadway traffic was plainly heard overhead, and, until the ear got familiar with it, sounded very strangely. This 294 feet takes the tunnel to Murray street, on the south side, nearly flush to the Post-Office fence.

The visitor to the tunnel is shown very clearly how this tunnel has been made, and how it is that the work has been carried on in a mole-like manner without attracting the observation of the Broadway pedestrians, and without interfering in any degree with the traffic. Having first obtained an entrance from the surface in Warren street, and gone deep enough to be out of the way of sewers, gas and water pipes, a cylinder was introduced, which in shape resembled a barrel with the ends out, forced by 18 hydraulic rams. This forces itself through the earth, and to moderate the fall of the earth, a munber of wooden shelves are placed within the cylinder for the earth to drop through; and as the carth deposits itself, it is shoveled up and carted away. In the course of the travels of this cylinder it came upon the remains of an old stone building, which was believed to be an old Dutch powder magazine. The stones were not too large to come through the shelves, and they were carted away with the earth. The cylinder has a projection in the front of it of steel, th broad and sharp, that finds no difficulty in cut g its way along. In the rear of it there is a thin piece of sheet iron, sixteen inches broad, upon which the brick work of the tunnel is built up; and when finished, the cylinder moves on again its earthy way, to have sixteen more inches of brick-work added.

From the New-York Times, Feb. 27, 1870.

THE BROADWAY TUNNEL.

OPENING THE BORE TO PUBLIC INSPECTION—SUCCESS OF THE UNDERTAKING—GREAT CROWD OF VISITORS.

CERTAINLY the most novel, if not the most successful, enterprise that New-York has seen for many a day is the Pneumatic Tunnel under Broadway. A myth or a humbug it has hitherto been called by every body who has been excluded from its interior; but hereafter the incredulous public can have the opportunity of examining the undertaking and judging of its merits. Yesterday the tunnel was thrown open to the inspection of visitors for the first time, and it must be said that every one of them came away surprised and gratified. Such as expected to find a dismal and cavernous retreat under Broadway, opened their eyes at the elegant reception-room, the light airy tunnel and the general appearance of taste and comfort in all the apartments; and those who entered to pick out some scientific flaw in the project, were silenced by the completeness of the machinery, the solidity of the work, and the safety of the running apparatus.

The entrance to this tunnel is on Broadway at the corner of Warren street. At the bottom of the steps is the entrance to an office, and the apartment of the "rotary blower," a huge paddle-box-like affair, neatly frescoed on the outside. To the right a door leads into a long hall, down a few more steps, and directly under the Warren street sidewalk, which is the "depot" of the establishment, and is handsomely fitted up with a fountain, paintings, and seats. This hall opens toward Broadway to the tunnel, at the cutrance of which stands a car ready for passengers. Adjoining the depot is the machinery for pumping the air in and out of the tube, which is worthy of an examination. The tunnel way itself, how it looks, how it is bored out, has been so often described in the various daily journals that only a brief account of it need be given here. The tube is eight feet in diameter, arched all the way round with brick painted white. From the bottom of it to the surface of Broadway is twenty-one feet, and it is therefore below all pipes and sewers. After curving around the corner of Warren street the tube is perfeetly straight. On the bottom is a track about four feet wide. The car which runs upon this is about half as large as a street-car, cushioned, lighted, ventilated, and elegant in all its appointments. The contrivance that bores out the tubes is a huge iron cylinder, sharp at the end penetrating the earth, and is forced along by hydraulic pressure. The dirt is then shoveled out. So far-the tube now being complete 120 feet, or as far as the south side of Murray street—the excavation has been through sand only, and not a difficult matter. Yesterday the gentlemanly engineer of the company explained the whole construction of the tunnel, over and over again, to the visitors that kept coming and going.

Such, in brief, is a description of the various compartments of the mysterious underground Broadway tunnel, begun but a few months ago. The enterprise is controlled by the "Beach Pneumatic Transit Company," who propose to run their tunnels in every direction eventually, and make rapid communication between distant parts of the city. They claim that their cars can run one mile a minute with

perfect safety by the pneumatic process.

The opening yesterday afternoon was a very pleasant "occasion." It was intended specially for dignitaries, legislators, aldermen, scientific men and members of the press, and scores of them were present. Mr. Beach himself was conspicuous, making his visitors explanations, and entertaining them like princes. Judge Daly, members of the American Institute, city officials, and many prominent citizens were observed among those who came. In the "depot," or reception-room, a first-class subterranean lunch was served continuously from two o'clock until six o'clock, and was continuously appreciated. The "health" of the tunnel was not forgotten. At nightfall, the unique occasion was over, but the "Transit Company" had made a host of friends and supporters.

_____••• New-York World, Feb. 27, 1870.

THE PNEUMATIC RAILWAY.

YESTERDAY afternoon, the first section of the Pneumatic Railway under Broadway, beginning at the corner of Warren street and extending to the south

side of Murray street, was opened for the inspection of members of the press and a large number of invited guests, including State officers, members of the Legislature, city officials, and many other gentlemen.

THE OUTER OFFICE.

Entering from the steps on Broadway, under the clothing store of Devlin & Co., the visitor finds himself in a light, airy apartment, 45 feet long and 12 wide, carpeted and fitted up in all respects like a first-class merchant's office; a part divided off for the occupancy of the presiding deity, and fitted with desk, office-stools, etc., the other part being for those having business with the officers of the company. At the further end of this room is seen the upper part of an immense cylinder, about 12 feet long by 8 in diameter, and faced by a prettily painted cog-wheel; and the visitor at once supposes that he sees the roof of the tunnel, and wonders how he shall get in; but this he afterward discovers is a mistake, and that the cylinder that he sees is only the casing to a large fan or blower, which is the motive power of the cars.

THE SALOON.

Turning to the right, through a pair of handsome folding doors, he finds himself in an elegant saloon, 120 feet long by 14 in width, the floor covered with oil-cloth of a pretty pattern, the walls hung with pictures, an expensive clock in the centre, elaborate chandeliers along the walls, comfortable settees at each side, and at the further end a space railed off for the occupancy of the ladies, with one of Chickering's grand pianos for their amusement while waiting for the train.

From the New-York Sunday Mercury, Feb. 27, 1870.

THE GREATEST OF OUR BORES.

UNDER BROADWAY—OPENING THE PNEUMATIC TUNNEL—FULL DESCRIPTION OF THE WORK—HOW THE EXCAVATION IS MADE—DISCOVERY OF ANCIENT RUINS—THE RAILROAD OF THE FUTURE—THE WORK TO BE CARRIED FROM THE BATTERY TO CENTRAL PARK.

Over a year ago, the papers announced that a company had begun tunneling Broadway for the construction of a pneumatic tube. When it was added that the work was begun under Devlin's store, at the corner of Broadway and Warren streets, all obtainable information was given; for the work was conducted with the greatest secrecy, and no one not known to be a workman in the employ of the company was allowed to pass the forbidden staircase. Different papers have given different accounts of the enterprise, but the opening yesterday must have convinced them all of the powers of human imagination. The south-west corner of Broadway and Warren

The south-west corner of Broadway and Warren street was crowded yesterday afternoon. A sign over the basement door—"Broadway Pneumatic Transit Co." -pointed the way to the new wonder; but energetic policemen refused admission to all who were not provided with the necessary invitation ticket. Soon after two o'clock, the guests began to arrive, and the lower rooms were speedily filled with members of the press and Legislature, city officials, and prominent gentlemen of the town.

Passing through the basement door, we enter the office, which is more than half occupied by the This blower is the vital part of the enterprise; for the air forced by it into and out from the tunnel will constitute the motive power. It can send out 1600 cubic feet of air per revolution, and can make sixty revolutions per minute. The air-chamber descends to the sub-cellar, where, on descending, we face the tunnel itself-a perfectly round opening, 8 feet in diameter, bearing off toward Broadway at an angle of about seventy degrees. The opening is arched, and neatly faced with bricks, and is surrounded with a circle of colored gas-jets. The tunnel, so far as completed, is 294 feet 6 inches long, of which 57 feet 6 inches are lined with iron, and the rest with brick. After the first 70 feet it becomes perfectly straight, and bears directly down Broadway. A car has been built, (as an experiment only,) and a light track has been laid, but a defect in the engine prevented its being put in motion yesterday.

Passing to the terminus of the opening, we involuntarily ask, "What digs?" All that meets the eye is a box-like arrangement, several iron tubes, and a little force-pump, small enough to be carried by one man. This, however, has done the work. The problem which the builders had to answer was, "How can we excavate this tube without opening or disturbing the street?" Digging would not do, since an opening less than 25 feet in circumference would allow little room for workmen. The method invented, and which has proved so successful, is as follows: A double iron cylinder, $5\frac{1}{2}$ feet long, was placed against the earth. Between the plates of this were placed eighteen hydraulic rams, fed from the pump before mentioned. Placing two men at the handle, they obtain by this hydraulic pressure a power of 126 tons bearing on the opposing earth. The soil, being sand, would fall in one mass unless supported, so this cylinder is divided into fourteen compartments by means of shelves, and the sand trickles down between them. As soon as a headway of ten inches is made, the brickwork is continued, and made a prop for the further progress of the cylinder. Rocks are the principal source of annoyance; but when small, they pass out between the shelves; and if large, are removed with crowbars, by taking out the shelves entirely. When Murray street was reached, serious resistance was encountered; and, on removing the shelves, a clearly-defined wall was disclosed. It appeared, from the section made visible, like the wall of a fort, and must have been of very ancient construction. If the work is carried to the upper portion of the city, the rocks will be drilled out by means of compressed air, as is done in the Hoosic tunnel.

The top of the tunnel as built is 12 feet below the surface of Broadway, thus being entirely out of the way of gas-pipes, sewers, etc. Even at this distance the noise in the street is plainly audible, coming like the hum of a cotton-mill rather than a continuous rumble.

Thus far, then, the work is a success. A perfect tunnel, 8 feet in diameter and nearly 300 feet long, has been made under Broadway, in its busiest portion, in fifty-eight days and ten hours working time, without disturbing travel or the street itself, and, in fact, without giving the public any idea of what was really in progress. But the company's charter allows them only to use a tube of 58 inches, and this for the transmission of packages. The original idea

was to divide this tube into smaller ones to operate in both directions. But the success of the large tube has seemed to give an answer to the problem, How shall an Underground Railway be constructed? And the company will now go before the Legislature for permission to use their tunnel for the transfer of passengers, and to extend it from the Battery to Central Park, on each side of the street. If this permission is obtained, over twenty openings will be made at once; and by working in each direction, the problem will soon be solved.

our illustrations on this page gives an interior view of the tunnel, looking south from near the entrance. It is eight feet in diameter, built of solid masonry, is dry and clean, painted white, and lighted with gas. The tunnel passes under all the gas and water-pipes and sewers: but, though so far below the surface of the street, the rumbling of wheels and the tramp of horses overhead can be distinctly heard by one standing within it.

The tunnel is constructed by means of a shield, consisting of a strong cylinder, something like a bar-



THE TUNNEL.

From Harper's Weekly, March 12, 1870.

UNDER BROADWAY.

The Pneumatic Tunnel, now in process of construction under the principal thoroughfare of New-York, commences in the sub-basements of the spacious marble building of Devlin & Co., corner of Broadway and Warren street, and extends, at present, to a point a little below Murray street. One of

rel with both heads taken out. It is pushed forward by eighteen powerful hydraulic rams, and makes a bore of its own diameter through the sand. The losened sand, as it falls through the rear end of the cylinder, is carried back through the tunnel in cars, and delivered upon an elevator on Warren street, where it is raised to the pavement and carted away. As fast as the cylinder advances, the tunnel is arched with masonry. By means of this machine, which

was designed by Mr. A. E. Beach, the tunnel is pushed forward without any interruption to the business of Broadway.

Another of our illustrations shows the mouth of the tunnel and a passenger-car, as seen from the station, which is a nicely-finished underground apart-



UNDER BROADWAY-A PASSENGER STATION.

ment 120 feet in length, lighted from the Warren street sidewalk. Another illustration shows the interior of the passenger-car, which carries eighteen passengers, has very comfortable seats, and is lighted with oxyhydrogen gas. The cars are to be propelled by the atmospheric system, consisting in driving through the tunnel a strong blast of air, which presses against the rear of the car and carries it along like a sail-boat before the wind. This air-current of course secures perfect ventilation within the car. The air is driven into the tunnel by means of an immense blowing-engine operated by steam. Mr. Joseph Dixon, long known for his efforts to establish the underground railway, is the superintendent of the work.



UNDER BROADWAY-INTERIOR OF PASSENGER-CAR.

As soon as the necessary authority can be obtained from the Legislature, it is the intention of the company to proceed to construct a first-class underground railway, with large cars, to run from South-

Ferry under Broadway to Central Park, and above that point; together with a Fourth Avenue branch to Harlem River. They will be able, when their arrangements are complete, to transport more than twenty thousand passengers per hour each way.

New-York Post, February 26, 1870.

THE PNEUMATIC TUBE.

A RECEPTION UNDER BROADWAY.

For the first time in the history of New-York a reception with all the accompaniments of furnished saloons, champagne and salads, was held under Broadway this afternoon.

The following invitation was issued a few days

UNDER BROADWAY RECEPTION.

To State Officers, Members of the Legislature, City Officials and Members of the Press;

You are respectfully invited to be present on Saturday, February 26th, 1870, from two to six o'clock P.M., at the office of the Beach Pneumatic Transit Company, 260 Broadway, corner of Warren street,

JOSEPH DIXON, Sec.

A. E. BEACH, President.

Owing to the lateness of the hour, we are able to give but a general outline of the enterprise.

On deseending the steps at the corner of Warren street and Broadway, the visitor finds himself in a neatly oil-clothed room, on the left of which appears the top of the rotary blower neatly painted. Advancing a few steps, the visitor turns to the right and descends three more steps, when he finds himself in a handsome and brilliantly lighted saloon. In the centre is a fountain with jetting water and gold-fishes swimming in the basin. The ceilings and sidewalls are hard-finished, and with neat striping about the gas brackets, present an attractive appearance. The floor is covered by oil-cloth, and the windows are hung with damask curtains and cornices. The surbase is of alternate stripes of walnut and white pine, and about the room are arranged settees and casychairs. A piano also adds to the attractiveness of the apartment.

Having reached this floor, the guest turns toward the City Hall Park, and descending another flight of steps, finds himself at the entrance of the tube, in full view of the vast machinery to be used for propelling the cars.

The top of the tunnel is surmounted by a keystone of pressed brick, over which are the letters in German text, "Pneumatic (1870) Transit," and encircling this is a row of gas jets, covered by alternate globes of red, white, and blue. At either side, on a pedestal, are bronze figures upholding a cluster of gaslights.

The next feature which strikes the spectator is the graceful curve of the tube into Broadway. The curved arch is supported by iron plates, and after a straight line is reached, the tunnel is continued down Broadway by arches of brick. The interior is painted white, and the entire length is lighted by gas. The track is supported by a bracing of hard wood.

The present length of the tunnel is 294 feet and 6 inches, and fifty-eight days and ten hours were consumed in constructing it. The track is 21 feet under the surface of Broadway, and the only circumstance

which would indicate that the visitor is under a busy thoroughfare is the constant rumbling of vehicles overhead. The car is built to conform to the shape of the tunnel, being semicircular in form. It has comfortable accommodation for twenty persons. The machinery is of immense power, and of very fine workmanship.

The visitors to-day were handsomely entertained by the officers of the company.

SKETCH OF THE HISTORY OF THE SYSTEM OF PNEUMATIC TRANSIT.

IN ENGLAND.

The idea of transporting passengers and goods by atmospheric pressure, within tubes, was first made public by George Medhinrst, an ingenious civil engineer of London, England. He published, in 1810, a description of his proposed atmospheric railway, which corresponds substantially with the successful works that have since been erected. But he was unable to find capitalists who were willing to coöperate with him in the development of his grand project.

The credit of first building a pneumatic railway, and demonstrating its feasibility by actually propelling a passenger-car by atmospheric pressure, unquestionably belongs to John Vallance, of Brighton, England. He erected a pneumatic tube of six feet diameter, at Brighton in 1826. Its operations attracted much public attention. Many of the leading noblemen visited the works and rode in the car. Its success was complete in every respect. Public meetings were held at Brighton to promote the construction of a pneumatic line to London, and Vallance succeeded in forming a company for that purpose-But before the capital stock was paid in, a general financial collapse took place, all the banks suspended, and new enterprises of every description perished, that of Vallance among the rest. He was arrested for debts incurred in building his tube, thrown into prison, and his pneumatic railway confiscated. His scheme faded from the public mind, poverty and imprisonment paralyzed his further efforts, and he died a poor, heart-broken man.

In 1842, W. H. James, C.E., promulgated his plan for rapid mail communication, which consisted in providing an atmospheric tube through which he proposed to propel balls, or, as he termed them, "hollow spheres," by atmospheric pressure. These balls were to contain letters, packages, and other freight; and the sanguine projector expected to realize a velocity of from three hundred to five hundred miles per hour. He claimed that tubes could be cheaply made, and that the balls would run with little or no friction. The plan attracted considerable attention, but nothing beyond the formation of a company and making of a few experimental models was ever done.

In 1861, a new organization, the Pneumatic Dispatch Company, having obtained parliamentary powers, began the laying of pneumatic tubes under the streets of London. Several miles of their tubes, which are about four and a half feet in diameter, are now constructed. They are employed for the transit of mails and freight. The cars are run at a velocity of thirty miles an hour. The works of the Pneumatic Dispatch Company have been in practical operation for the past nine years, and have demonstrated beyond all question the economy and success of the pneumatic system of transit. The engineer of the London pneumatic works is Mr. T. W. Rammell, who is also the inventor and patentee of several improvements pertaining to atmospheric railways. Sir Charles Fox & Sons, of London, a distinguished engineering firm, are also prominently connected with the pneumatic railway enterprises in England, and have actively promoted their success.

In 1864, a large tunnel for passenger-cars was erected at Sydenham, \(\frac{1}{4} \) of a mile long, and thousands of passengers were transported by atmospheric pressure. This resulted in the incorporation of the Waterloo and Whitehall Railway, which is to extend from Charing Cross under the Thames to the Southwestern Railway. The tunnels of this great pneumatic railway are 13 feet in diameter, and have been laid under the Thames embankment for a short distance under the river. The sub-river tunnel is built in iron sections, each 212 feet long, covered with brick, and sunk in a bed dredged out on the bottom of the river.

Allusion ought here to be made to the imperfect form of pneumatic railway, known as the slotted tube, tried in 1845-46, in Ireland and England, also in France, where for fourteen years it was in constant use on the St. Germain Railway. In these examples, a small air-tube was laid on the surface of the ground between the ordinary rails. The tube was slotted, and an arm extended down from the car through the slot to a disk or piston, which traversed the interior of the tube. The slot was covered by a rope which served as a valve. When the air was exhausted from the tube, the piston moved and carried the cars along.

Passengers were transported in some cases at a velocity of sixty miles an hour by this method. In point of economy, however, the slotted tube is too imperfect to compete either with the steam locomotive or with the larger and more correct form of pneumatic railway, in which the cars run wholly within the tunnel. "It is an old notion," says the London Mechanic's Magazine, "and by no means an erroneous one, that the power acquired by atmospheric pressure would realize greater safety, economy, and expedition than that attained by the ordinary locomotive.

The trial of the system of atmospheric propulsion for fourteen years, on the line from Paris to St. Germain, bears witness to the absolute security attending its adoption. We have also had practical experience in this direction on some of our own lines."

IN THIS COUNTRY.

In this country, one of the earliest recorded efforts to introduce the pneumatic system was that of James Spicer, in 1832, who proposed to lay a series of tubes between New-York and Philadelphia, in five-mile sections, the vehicles to be operated by atmospheric power, each section being operated by two engines, one at each end, respectively producing air compression and exhaustion. Mr. Spicer's first essay was to procure the indorsement of his plan by the Scientific Committee of the Franklin Institute of Philadelphia. He accordingly presented himself before that body, and produced a working tube eighteen feet long, which operated with entire success. The learned committee reported that they regretted that Mr. Spicer should have incurred expenses in bringing his invention before the public, and then proceeded to give various experimental proofs to show that the idea of driving the air through the tubes was impracticable. This was such cold comfort for Mr. Spicer that he proceeded no further. Considering that, a few years subsequent to Mr. Spicer's application, passenger-trains were run at the rate of sixty miles an hour in England by means of slotted atmospheric tubes, the conclusions of the committee are quite refreshing.

Public attention was next directed to the atmospheric system by Ithiel S. Richardson, of Boston, Massachusetts, who put a small tube, nearly one quarter of a mile long, into successful practical operation. He obtained patents, in 1853, for an atmospheric railway and telegraph. He expected to send the mails between Boston and New-York—two hundred and forty miles—in one hour. The aid of Congress was invoked for the building of an experimental line, but no appropriation was made.

In 1867, a tube of sufficient size for the transit of passengers was erected in the Armory building, Fourteenth street, New-York. It was constructed by Mr. A. E. Beach, of the *Scientific American*, and was operated for several weeks, during the exhibition of

the American Institute. The car carried fourteen persons, and about one hundred thousand visitors enjoyed the atmospheric ride. This is believed to be the first passenger pneumatic tube operated in this country.

In 1869, Mr. Albert Brisbane obtained a patent here for driving hollow balls or spheres through tubes by atmospheric pressure. This plan appears to be identical with that of Mr. James, 1842, before mentioned.

The present pneumatic tunnel under Broadway is the most recent work connected with the pneumatic system on this side the Atlantic. In England, France, and Belgium, small pneumatic tubes have for several years been in practical operation, chiefly for postal purposes.

TUNNEL PHOTOGRAPHS.

WE are indebted to Messrs. Rockwood & Co., 839 Broadway, mechanical photographers, for a series of stereoscopic and other photographs illustrating the Pneumatic Railway under Broadway. As the works are entirely below the surface of the street, artificial light was employed, in the use of which the photographers have been very successful. The illumination was obtained by means of two large and powerful oxyhydrogen calcium lights. Photography has been brought to such perfection that even the bowels of the earth yield to it their mysteries, and Broadway has proved no exception. The pictures were taken with the entire travel of the street, omnibus, carts, carriages, and steam fire-engines, all trotting directly over the head of the artist. - Scientific American.

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